

Abstract

An injector for fuel injection systems of internal combustion engines, in particular direct-injection diesel engines, has a piezoelectric actuator (16), which is contained in an injector body (10) and acted on by a first spring mechanism (35) so that it remains in contact with the injector body (10) at one end and with a sleeve-like booster piston (33) on the other. In addition, a nozzle body (20) is provided, which is connected to the injector body (10) and has at least one nozzle outlet opening (26, 27), and in which a stepped (first) nozzle needle (21) is guided in an axially movable fashion, and a (second) spring mechanism (54) is provided, which is contained inside the booster piston (33) and, together with the injection pressure acting on the rear end of the (first) nozzle needle (21), holds the (first) nozzle needle (21) in the closed position. The injector also has an (outer) control chamber (47) that is embodied at the nozzle needle end of the booster piston (33) and communicates via at least one leakage gap with a fuel supply (18) under injection pressure; the fuel contained in the control chamber (47) acts on the (first) nozzle needle (21) in the opening direction (55). A rear region (31) of the (first) nozzle needle (21), which has a larger diameter than a nozzle outlet region of the (first) nozzle needle (21), is fitted into the internal chamber (32) of the booster piston (33).

An essential feature is that the first nozzle needle (21) has a concentric axial recess (39) passing through it, which is stepped by means of a shoulder (38) and has a second nozzle needle (41), which is likewise correspondingly stepped by means of a shoulder (40), fitted into it in an axially movable fashion; inside the axial recess (39) – between its shoulder (38)

and the shoulder (40) of the second nozzle needle (41) – a (second) inner chamber (52) is formed, which is hydraulically connected to the (first) outer control chamber (47); and the control chamber volumes and the surfaces of the nozzle needles (21, 41) – which are acted on by the control chamber pressures, the pressure of the fuel supply (18, 19), and the spring mechanism pressure – are matched to each other so that the two nozzle needles (21, 41) open in succession in response to a change to the electrical voltage applied to the piezoelectric actuator (16).

(Fig. 1)